

### Claims

1. *(Currently amended)* A magnetic recording disk comprising:
  - a substrate;
  - a first lower ferromagnetic layer on the substrate and having a remanent magnetization  $M_r$ , a thickness  $t$  and a remanent-magnetization-thickness product  $Mrt$ :
    - a first antiferromagnetically coupling layer on the first lower ferromagnetic layer;
    - a second lower ferromagnetic layer on the first antiferromagnetically coupling layer and having an  $Mrt$  less than the  $Mrt$  of the first lower ferromagnetic layer;
    - a second antiferromagnetically coupling layer on the second lower ferromagnetic layer;
    - a third lower ferromagnetic layer on the second antiferromagnetically coupling layer and having an  $Mrt$  greater than the  $Mrt$  of the second lower ferromagnetic layer;
    - a third antiferromagnetically coupling layer on the third lower ferromagnetic layer; and
    - an upper ferromagnetic layer on the third antiferromagnetically coupling layer and having an  $Mrt$  greater than the sum of the  $Mrt$  values of the first and third lower ferromagnetic layers.

9. *(Currently amended)* A magnetic recording disk comprising:  
a substrate; and

an antiferromagnetically-coupled structure on the substrate and having two remanent magnetic states in the absence of an applied magnetic field, the structure comprising

(a) a first lower ferromagnetic layer having a remanent magnetization  $M_r$ , a thickness  $t$  and a remanent-magnetization-thickness product  $Mrt$ ; (b) a first antiferromagnetically coupling layer on the first lower ferromagnetic layer; (c) a second lower ferromagnetic layer on the first antiferromagnetically coupling layer and having an  $Mrt$  less than the  $Mrt$  of the first lower ferromagnetic layer; (d) a second antiferromagnetically coupling layer on the second lower ferromagnetic layer; (e) a third lower ferromagnetic layer on the second antiferromagnetically coupling layer and having an  $Mrt$  greater than the  $Mrt$  of the second lower ferromagnetic layer; (e) (f) a third antiferromagnetically coupling layer on the third lower ferromagnetic layer; and (f) (g) an upper ferromagnetic layer on the third antiferromagnetically coupling layer and having an  $Mrt$  greater than the sum of the  $Mrt$  values of the first and third lower ferromagnetic layers;

and wherein the magnetization directions of the upper ferromagnetic layer and the third ferromagnetic layer are substantially antiparallel in each remanent state, the magnetization directions of the second lower ferromagnetic layer and the first ferromagnetic layer are substantially antiparallel in each remanent state, and the magnetization direction of the upper ferromagnetic layer in one remanent state is substantially antiparallel to its magnetization direction in the other remanent state.